From:	Kubo, Teresa
To:	Henning, Alan
Subject:	FW: Forestry effects at the WRC paired watershed studies
Date:	Wednesday, March 12, 2014 11:10:36 AM
Attachments:	FW Watershed Research Conference and Stream Temperature.msg Watershed Research Cooperative Policy Workshop Notes_November 2013.docx

Hi Alan,

It looks like you got this from Josh already. I'm resending because this is the email I was referring to yesterday when we talked about the Trask Science Symposium. I'm glad Josh is going to be there. It will be interesting to hear what messages he takes away.

Take care,

Teresa

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From: SEEDS Joshua [mailto:SEEDS.Joshua@deq.state.or.us]
Sent: Tuesday, January 07, 2014 12:53 PM
To: Leinenbach, Peter; Kubo, Teresa; Henning, Alan; Powers, David
Cc: SEEDS Joshua
Subject: Forestry effects at the WRC paired watershed studies

Pete et al,

Attached is the email I sent to DEQ staff and managers after last April's Paired Watershed Study Symposium, describing claims I heard by some presenters that do not seem to be scientifically grounded. Also attached are my meeting notes for November's "Policy Workshop". The basic line of argument is that the fish seem to be fine in the very short-term, so there are no problems. Within my meeting notes are a mix of my recollections of the presentations themselves along with notations and issues that I noticed. I have tried to mark my notes using brackets and other sorts of labels. Both of these events deal with the three ongoing paired watershed studies in Oregon (Hinkle Creek, Alsea Revisited, Trask River).

This information is FYI only for you all. I don't want this widely spread at this point, as the means and timing of publically disagreeing with the opinion of some of the assertions being made is very important. There will be a more detailed assessment of DEQ's take on the science from these paired watershed studies forthcoming; that will be something which is more widely distributed. Any help that you are able to give in assembling the evidence (published studies or new analysis) that shines light on unfounded claims being made would be most appreciated.

Let me know if you have any questions or comments.

Thanks,

Josh

Joshua Seeds
Nonpoint Source Pollution Analyst
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From:	SEEDS Joshua
To:	FOSTER Eugene P
Cc:	SEEDS Joshua
Subject:	FW: Watershed Research Conference and Stream Temperature
Date:	Wednesday, May 08, 2013 4:57:39 PM

Gene,

Julia and I attend the Watershed Research Cooperative's conference on Thursday, April 18th. Researchers presented results for the 3 ongoing paired watershed studies examining the effects of contemporary forest practices in Oregon; some of those results we have seen before. (The 3 paired watershed studies are Hinkle Creek, the Trask River, and Alsea Watershed Revisited.) All harvests were done according to current FPA rules. All studies use a Before/After-Control/Impact design, although only the Trask River study uses any real replication. Most of the research was presented in fairly objective fashion, although there were a few eyebrow raising conclusions or implications about which I think I ought to tell you all.

Beneficial Use Evaluation:

Firstly, the studies are examining beneficial uses directly in addition looking at water quality parameters. *Macroinvertebrate communities have shifted to more sediment-tolerant genera in the Hinkle Creek treatment watershed.* The primary fish studied (and really the only fish studied considering the short-term post-harvest period) is cutthroat trout, a disturbance-tolerant salmonid. Growth rates were increased for the older fish, and no population increases or decreases were observed. *The results thus far support the notion that no* ***short-term*** *adverse effects were seen for cutthroat trout.* There is no inference for long-term salmonid population effects, and starting (and ending) stream temperatures were well below the biological criteria.

Temperature at Hinkle Creek:

Four non-fish bearing tributaries of South Fork Hinkle Creek were harvested, followed by harvest along SF Hinkle itself 4 years later. The tributaries were ~55% to ~85% shaded by slash (like a tent, not in the water) and flows increased substantially as is typical after a clearcut harvest. As a result, two tribs showed no change in temperature, one went up by 1°C, and one went down by 1°C (the one with the most shade, of course). SF Hinkle Creek itself showed no response to harvest.

Claim Made: Anyone looking for cumulative effects wouldn't have found it here!

Fact Check: There were no overall effects to accumulate. Because the tributaries were shaded so heavily by slash, incident solar radiation was low on the non-fish tribs despite have no vegetation buffer (1+-1+0+0=0; not exactly a real heat budget, but you get the idea). In addition, these are all gaining reaches that consistently add flow from groundwater as the streams go downhill. *Rather than proving the there are not cumulative effects from multiple upstream harvests (the implication), this study successfully demonstrated that retaining some kind of shade on non-fish tributaries protects downstream fish-bearing reaches from temperature impacts.*

Temperature at Needle Branch (Alsea Watershed Study Revisited):

In the end, two harvests will have been done along Needle Branch. The upstream section was harvested a few years ago; the downstream section will be harvested soon. Pre-harvest analysis seems to have verified that Needle Branch's temperature regime has recovered from the rough treatment during the original study in the 1960's. Seven-day average of daily maximum temperature at the bottom of the harvested reach rose by a statistically significant 0.7°C (the same as the average 7dAM temperature increase in harvested private forest reaches in ODF's RipStream study). The 7dAM temperature increased by 0.3°C at the bottom of the downstream unharvested section

of Needle Branch (not significant at a=0.05, significant at a=0.10).

Claim Made: No exceedances of biological criteria, so no problem!

Fact Check: Stream temperatures are below 16°C (near 14°C typically), so substantial heating would be necessary to exceed the biological criterion. This does, however, show a violation of the Protecting Cold Water Criterion at the end of the harvested reach and possibly farther downstream as well. *Full recovery of pre-harvest temperature is **not** seen after passing through a forested section, despite increased flows post-harvest.*

Flow/Sediment at Hinkle Creek:

Flow substantially increased in the harvested tributaries and Hinkle Creek itself. Sediment export from the watershed increased as well. It is unknown whether this is due solely to more stream bed and bank erosion from increased flows, or whether there was additional sediment supplied from the harvest units, roads, and/or riparian disturbance. There was a substantial dam-break flood in one of the tribs which surely had an impact. More analysis is forthcoming. *More suspended sediment moved through the system, although we don't know why.*

Sediment at Trask River:

The first sediment results are available from the Trask River study, evaluating the effects of road construction and refurbishment. There is a slight but statistically significant increase in turbidity below roads' stream crossings. It is quite small, but it is there. It may just be loose stuff right after road work (this would be typical). I'm not sure if this shows anything new or significant (road work=short-term sediment generation), but it needs watching as it develops, especially given that we are giving current FPA rules the benefit of the doubt for new roads.

Let me know if you have any questions or want to discuss.

Thanks,

Josh

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Watershed Research Cooperative (WRC) Policy Workshop

November 13, 2013

Joshua Seeds (Oregon DEQ) Meeting Notes

[Comments in brackets or marked by "**Note:**" are mine.]
Presentations are online at: http://knowyourforest.org/events/conferences. Click on the link for the November 13, 2013 WRC Policy Workshop for links to the agenda, handout packet, and all presentations.

Thomas Maness, OSU College of Forestry Dean (Opening/Closing Speaker)

- Covered 3 areas:
    1. Forest practices code/policy should be based on science
    2. Goals about management practices change, and this requires new science
    3. Forestry is a classic continuous improvement issue—adaptive management
- Three-pronged approach:
    1. Land use planning—keeping forest as forest
    2. Regulation (FPA)
    3. Voluntary measures, ecosystem services, and the like—Going above and beyond

    Challenge: Make these science-based
- Four types of science questions (need to be relevant and unbiased):
    1. Is there an effect?
    2. Is the effect significant (biologically/ecologically)?
    3. What is the cause of the effect?
    4. How can that be managed?
- He discussed water quantity effects. Harvest increases streamflows initially. He talked about short-rotation forests in South America consuming large amounts of water, causing problems for agricultural production downstream. [There are studies showing depression of low flows in plantation in Oregon at 20-35 years of age.]
- He discussed long-term impacts in general and in relation to the short time frame of the paired watershed studies [maximum 5 years post-harvest]—Some disturbance can be good in the short term, what about the long term?
- Announced OSU is starting an Institute for Working Forest Landscapes focusing on 4 things:
    1. Resilient Ecosystems
    2. Healthy Communities & People
    3. Innovative Products
    4. Intensively-Managed Forests (including their role in preserving native forests)

Liz Dent, ODF (Overview of the WRC Studies)

Reference: Ice & Stednick, 2004 from *Forest History Today*

- Discussion of difference between reach scale research and watershed scale research
- Three primary questions related to small non-fish-bearing streams [paired watershed studies also look at fish-bearing streams]:
    1. What are the effects on small, non-fish-bearing streams?
    2. If changes are observed, are they also observed downstream?

3. What do the physical/chemical changes mean for the biology?

- Made reference to a 20-40% increase in suspended sediment.

  [I asked Liz where this figure came from after the workshop, mentioning that I had seen a lot of seasonal variation and variation between streams. She said she got the number from Arne Skaugset but didn't know how he came up with it. This needs checking.]
- Studies include a recognition that the landscape has a history of management and inherent landscape differences (Contextual Analysis).
  - For example, Trask has earthflow terrain that is less responsive to rainfall and has a moderated drop in summer flow and a history of intensive harvest and fire in the 1920s through 1940s.
- Changes are difficult to detect within observed variation.

George Ice, retired, NCASI

- Didn't focus on WRC studies but instead:
  1. FPA reduces impacts.
  2. Water quality and riparian ecosystems recover over time.
  3. Water quality criteria are sometimes unattainable.
  4. Technology allows detection of small changes.
  5. Law of Diminishing Returns.

  Reference: Ice & Shilling 2012 (describes 100 years of BMP research)
- "Distorted Perspective" characterization of views on forest practices. **[This is a classic Strawman argument.]**
  - People confuse effects of past practices with present practices.
  - People focus only on immediate impacts. [He argues for averaging effects over the length of a rotation. This downplays the larger impacts in the time period just after harvest and ignores the importance of timing as well as magnitude of impacts. It is useful for comparison with other land uses such as agriculture.]
- Discussion of sediment from roads as an example on learning and adjusting practices.

References: 2007 Mica Creek study in ID (Karwan *et al* 2007, probably); Martin 2009 (Forest Road Runoff Disconnection Survey of Private Timberlands in Washington. Washington Forest Protection Association, Olympia WA.); Dubé *et al* 2010 (WA CMER 08-801); Furniss, M. J., S. Flanagan, and B. McFadin. 2000. (Hydrologically-Connected Roads: An Indicator of the Influence of Roads on Chronic Sedimentation, Surface Water Hydrology, and Exposure to Toxic Chemicals. Stream Notes. URL: http://www.stream.fs.fed.us/news/streamnt/ jul00/jul00_2.htm). Reiter *et al* 2009 on turbidity patterns in a Western WA watershed, which interpreted turbidity decreases as being due to roads.

- Makes historic sediment increases vs. Hinkle Creek increases in sediment.
  - Gives 40% increase figure from Hinkle **[not sure where they got this figure]**.
  - **Core argument:** There is a big difference between then and now, so it is alright now. [It is noteworthy that there are still increases over the natural variation in the treated watershed at Hinkle Creek.]
- For Hinkle Creek he compared absolute temperature on control and treatment watersheds instead of changes—change is the relevant metric when discussing forest practice effects.
  - Claims no shift in temperature at Hinkle but only slight mention of shade and slash covering small Type-N streams—with high shade retention we expect little to no

temperature change. The results are consistent with RipStream: high shade=little to no temperature change.
    - Gives information on coho productivity variation with temperature [assumes sufficient food resources which is not necessarily true].
- On Alsea, compares absolute temperatures in control and treatment watersheds in first summer post-harvest, but does not show change in relationship between the control and treatment—the relevant metric.
- Shows data from Texas study with Tropical Storm Allison in pre-harvest period (McBroom *et al* 2008). [Not necessarily relevant to Pacific Northwest, but it is interesting to see that harvest is nearly equivalent to a natural disaster.]
- Recovery of water quality over time (through harvest rotation) & downstream (in unharvested locations):
    - Major focal point for rhetoric.
    - Ignored existence and effects of multiple harvests on a stream system or at the watershed scale.
    - Showed data demonstrating recovery 30 years post-harvest.
    - Hinkle graph showing recovery downstream didn't have full recovery and the "recovery" was groundwater influx, not dissipation of acquired heat.
- Large degree of emphasis on natural cases on non-attainment of water quality.
    - [DEQ expects there to be natural cases on non-attainment in dynamic ecosystems.]
        - [DEQ policy is to prevent human increases of natural *rates* of non-attainment.]
    - **[Temperature portion has no info on natural or human *rates* of non-attainment**.]
    - Discussion on temperature variability at Hinkle and occurrence of temperatures greater than 16^{o}C pre-harvest.
    - Needle Branch in the Alsea Study had pre-harvest dissolved oxygen (DO) problems
        - Sub-surface at times and places so reductions in DO with increases as flows respond to storm events.
    - Mention of biocriteria impairment in Alsea control watershed (Flynn Creek).
    - Nitrate-nitrogen "may" be high due to alder—no numbers, data, or specifics. [Just speculation.]
    - **[Lack of specifics or cited examples.]**
- Argues that better measurement tools are allowing measurement of changes that are not ecologically significant—no examples or studies of when and how this is the case.
- [On suspended sediment: Seems to be conflating annual variability with average response to management.]
    - **[Lacks context and ecological relevance.**
    - **No discussion of timing, magnitude, sediment quality, co-occurring material (LWD) inputs.]**
- Law of Diminishing Returns:
    - Claimed that we aren't going to get enough environmental benefit to justify increase in protection.

  References: NCASI TB 799, mentions Comprehensive Economic and Environmental Assessment Tool.

Judy Li, retired, OSU Dept of Fisheries and Wildlife

- Macroinvertebrate research at 3 paired watershed studies
- Main messages:

1. High variation in densities and composition.
2. Variation in life history (longevity vs. colonizers).
3. Variation in sensitivities (to water quality, sediment, temperature effects).

- Healthy assemblages are diverse.
- Replication at studies: Hinkle-24 sites, Trask-16 sites, Alsea-6 sites.
- Research Questions:
  1. What are spatial and temporal patterns pre-harvest?
  2. How will they change after harvest?
- Yearly pre-harvest variation and seasonal variation is present.
- Fish diet is mostly terrestrial macroinvertebrates in summer, about ½ terrestrial in spring and autumn at Hinkle Creek.
- Pre-harvest at Hinkle and Trask: Headwater assemblages are different from downstream (multivariate analysis with density, taxa composition, % midges (Chironimidae).
- Pre-harvest: 3 paired watershed study areas each have distinctive assemblages.
  - Few macroinvertebrates common to all 3 watersheds.
- Headwaters harvest at Hinkle:
  - Multivariate analysis shows sharp 4-years post-harvest distinction at Hinkle Creek driven by midges.
    - Midge density increased.
    - Overall macroinvertebrate densities increased, driven by midges.
    - Species richness decreased due to loss of sensitive taxa.
  - No immediate downstream effects detected after headwaters harvest.
- Mainstem harvest at Hinkle:
  - Midge density increased.
  - Species richness decreased.
  - Fish diet responded to midge availability.
    - Little change in spring macroinvertebrate sources of fish diet.
  - Overall density did not increase (hypothesize that it is related to increase in cutthroat trout biomass: more fish keeping the density the same).
  - Adult insect emergence increased at Hinkle; Alsea hard to say (little replication, no pre-harvest data); Trask emergence data collected.
- No apparent changes at Alsea in density (low sample size makes significant results statistically unlikely.)
  - Increase in terrestrial macroinvertebrates in cutthroat trout diet post-harvest.
- Trask expanding measurement types.
- Importance of context:
  - Annual & seasonal variation.
  - Management history.
  - Biota are particular to each watershed.
  - Headwaters are different than downstream (mainstems).
- Exploring application to macroinvertebrate standards, water quality, sedimentation.
- Explore models for prediction of macroinvertebrate community for use by ODF, USFS, etc.
- Funding from NCASI to look at “regional invertebrate standards, water quality, sedimentation”.
  - [May be related to Biocriteria listings.
  - **Check with Ryan M. and Shannon H.**
  - **Follow up with Judy Li.]**
- Explore prediction models for ODF and USFS.

Doug Bateman, OSU Forest Engineering, Resources, and Management

At Hinkle Creek:

- Tributary harvests (1st entry) and Mainstem South Fork harvests (2nd entry).
- Distinguished between results at the fish-bearing tributary scale and the catchment scale.
- Metrics are: Biomass, Abundance, Size, Growth, Condition, Survival, Behavior.
- Hinkle Creek tributary harvest:
    - Age 1+ cutthroat trout biomass increased, abundance increased in treatment at tributary scale.
    - No changes in Age 0 trout.
    - No changes at catchment scale.
- Hinkle Creek Type-F harvest:
    - Age 1+ cutthroat trout biomass increased, size increased at the tributary scale.
    - Age 0 trout biomass increased, abundance increased, size increased, at the tributary scale.
    - Age 1+ trout size increased, growth increased at the catchment scale.
    - Age 0 trout biomass increased, abundance increased, size increased at the catchment scale.
- Steelhead were increasing in the South Fork and decreasing in the North Fork pre-harvest so no change can be detected.
    - Steelhead down, then up in South Fork post-harvest.
- No habitat changes observed (Pool Area, Length, Depth, Fine Sediment).
    - **[Other than possibly fine sediment, habitat processes happen over decades rather than months or years. Not necessarily reasonable to expect habitat changes at these time scales without direct disturbance of stream channels or massive influx of fine sediment.]**
- **DEQ Question:** In what season was harvest done in all these studies? Dry season only or was there wet weather harvest?

Alsea Study harvest:

- Age1+ trout had biomass increase, abundance increase.
    - Both on upward trajectory prior to harvest.
- Age 0 trout had size decrease.
- Coho salmon had no change.

- Habitat had increase in pool area, no change in pool length, depth, fine sediment, or fish cover.
- Hypothetical response curves shown to look at longer time scales [don't think this was easy for most to understand—very technical].
    - **References:** Mellina and Hinch 2009 (meta-analysis with no buffer); Gregory *et al* 2008.
    - Fish responses to logging appear to be typically mixed. Some reductions in pool volume common. Results mixed in the literature. Streams that were "cleaned" frequently have negative responses for salmonid density and biomass—gives indication of what happens over time with loss of large woody debris due to decay and lack of recruitment.
    - Does not look at winter effects, neither does Hinkle Creek.
    - Short-term negative responses for habitat—frequently, but not always, associated with LW removal.
- **DEQ Question:** Did increased water quantity make the difference?
- Increased system productivity in the short term.

- Long-term effects?
    - Large woody debris recruitment changes (greater or less); is there cumulative downstream heating in rearing and migration areas, migration corridors; etc.
- **DEQ Questions:** How will fish respond through time? What are the changes to habitat over time? Will reductions in trees available to become large woody debris result in habitat degradation as large wood decays and is not replaced?

Arne Skaugset, OSU Forest Engineering, Resources, and Management

(Part of group which reviewed white papers from FPAC, NOAA, Coastal Coho MOA committee)

- "Counterintuitive Results" [Part of an extended Strawman characterization/ false dichotomy].
- Topics:
    1. Sediment or Accelerated Erosion.
    2. Temperature.
    3. Fish Populations.
    4. Watershed Hydrology.
- **Claim made (verbally):** Clearcut size and adjacency limits in rules means that whole watershed cannot be harvested, proportion that can be recently harvested is "small".
    - **Note:** Free-to-grow stands (approx. 5-6 years) are not a clearcut for purposes of size and adjacency limits. Whole watershed can be harvested within approx. 10 years, well shorter than water quality and hydrologic recovery times.
- **Claim made:** Flow changes due to harvest in WRC studies equal to 4-10 inches of rain, [I think he said a 6-7% increase in flow, similar to a wet winter.
    - **Note:** A wet winter has hydrologic and ecological implications in comparison to a dry winter.
    - Describes a shift where a dry winter=pre-harvest wet winter; wet winter=very wet winter.
- **Claim made:** Streamflow changes "within the natural variability of system".
    - **Note:** "Similar in magnitude to natural variability of the system" is an accurate way to state this, as changes would be indistinguishable from the control if they were "within natural variability".
- Sediment increases acute in studies of pre-Forest Practices Act or pre-1994 forest practices.
    - Broadcast burning for site preparation connected to sediment pulses, contrasted with logging/yarding operations.
    - Better road practices and riparian buffers on many streams.
    - Aerial herbicide spraying claimed as better than broadcast burning.
        - No comparison of other alternatives to either practice.
- Example studies of contemporary practices are Caspar Creek (CA), Mica Creek (ID), and Hinkle Creek (OR). [No literature citations given.]
- Monthly sediment yield for North Fork Hinkle vs. South Fork Hinkle has no big change.
    - No figures given, just a graph.
    - Large events ignored, not discussed—known to be major drivers of sediment regimes.
    - Compares to Hicks *et al* (1991), apparently uses original Alsea data, characterized by Dr. Skaugset as "logging kills ½ of fish".
        - **Note:** Hicks *et al* (1991) ascribed declines in cutthroat trout abundance over the long-term to lower summer low flows a decade or more after harvest (driven by young trees' water consumption), not suspended sediment.

- Numerous mentions of large, acute response with past practices compared to current practices having small, chronic response.
    - Buffers on fish-bearing streams (but not non-fish streams) and an end to "stream cleaning" (LWD removal) implied to have fixed problems related to forest practices.
    - [Effects/importance of small, chronic responses downplayed.]
    - [No mention that past practices have a legacy and had small, chronic effects that could not be detected at the time that were overshadowed by acute damage.]
- Hinkle had 0.5^{o}C increase with range of -1.8 to 2.5^{o}C [I think this refers to response on Type F (mainstem) of South Fork Hinkle Creek; not sure to what the range refers—different probes or variation through time at a single probe?].
    - Compared this to RipStream results with average 0.7^{o}C increase with a range of -0.9 to 2.5^{o}C.
    - **Note:** RipStream has n=18 for private forest sites, misstated as n=33; Hinkle has n=7 [Type F and Type N streams' probes combined?].
    - **Claim Made:** No large impacts; results "small, chronic, and equivocal".
    - **Note:** This is a False Equivalency fallacy that effect size=importance—not supported by science.
    - Graph comparing absolute stream temperatures pre- and post-harvest in treated watershed—relevant metric is change in relationship to control.
- Type-N streams:
    - **References:** Jackson *et al* 2001; Janisch *et al* 2012; Kibler *et al* (in press); Gravelle & Link 2007.
    - **Note:** Compared results to Strawman "expectations" of unspecific persons rather than actually presenting results.
    - **Note:** Claims that "equivocal results" (undefined term) for these studies, appears to be some kind of false equivalence to the more precise term "variability among results".
    - Mentions slash caves covering headwater streams and discontinuity in surface flow.
    - No mention that Hinkle study was not able to test results of increased headwaters temperatures on downstream Type-F stream temperature due to shade from slash on Type-N streams.
        - Hinkle evidence showed that shade retention prevents increases.
    - **Claim Made:** There is no evidence from Hinkle Creek that stream temperature increases can propagate and accumulate downstream; reference to Mica Creek study.
        - **Note:** This hypothesis could not be tested with the evidence from Hinkle Creek because small non-fish streams were shaded by slash.
    - **Claim Made:** "Stream processes investigated don't support the concept that it can [heat increases can move downstream and accumulate] (i.e. advected heat from groundwater and water residence time)."
        - **Note: No evidence presented** to support these assertions or any acknowledgement that these **concepts could not be tested with the evidence available** from the Hinkle study.
- Contemporary practices have eliminated large acute impacts.
- Contemporary practices do results in detectable impacts (small, chronic impacts) which are claimed to be equivocal (see above note).
- **Claim Made:** Changes are "within the range of natural variability in space and/or time."

- **Note:** As with regard to streamflow changes, "Similar in magnitude to natural variability of the system" is an accurate way to state this, as changes would be indistinguishable from the control if they were "within natural variability".

Policy Maker Panel:

Questions for consideration by Policy Maker Panel at this work shop. Bullet points are my comments on the questions.

1. Based on what you heard today or other evidence you have seen, do you believe that there is scientific evidence for making changes in policies regarding riparian protection during timber harvest?
   - FPA policy is economically efficient forestry where rules cannot currently be shown to cause resource damage. When monitoring shows resources (including water quality and fisheries) are not being protected, then the rules must be changed.
     - A precautionary approach (a different policy) would require that rules minimize risk and preserve ecosystem resiliency. There is a gray area in between these two approaches.
   - If the question is ***rule*** changes, rather than ***policy*** changes:
     - Current riparian rules on small and medium fish bearing streams result in reduced shade and increased stream temperature (see RipStream study), failing to meet the Protecting Cold Water criterion of the Temperature Standard.
       - 5% exceedance rate in controls, pre-harvest private forestland, and pre- and post-harvest state forestlands.
       - 40% exceedance rate in post-harvest private sites.
     - Shallow landslide incidence increases on clearcuts. Such slides from clearcuts lack large wood which is important for sediment regulation/routing and habitat creation. Current landslide rules are designed to protect public safety but not designed to protect water quality or aquatic habitat.

2. How do you make a policy decision? What thought process do you use? What information do you seek?

3. What information is lacking to make policy decisions regarding riparian protection during timber harvest?
   - Uncertainty is always present. We need a good framework for making decisions in the face of uncertainty.
   - Relatively small changes in water quality and/or habitat are not necessarily insignificant, especially over large areas or over long time scales. Small changes can have significant effects on complex systems.
   - Currently, we need a more recent assessment of the effects of forest practices on the sediment regime (landslides, flow effects, erosion, large wood recruitment, sediment movement and fate) that includes seasonal and large event effects. For example, daily sediment yield during the winter increased by 288% in the South Fork of Hinkle Creek. BB, Clay, and Fenton Creeks had daily sediment yield increases during the winter which ranged from 42%-132%.

4. How do we deal with the fundamental policy conflict the Oregon Forest Practices Act and the Cold Water Anti-degradation Standard [*he means the Protecting Cold Water criterion of the Temperature Standard*]? The first calls for preserving healthy populations of fish, while the second calls for no measureable impact from human activity.
    - FPA implements water quality laws on non-federal forestlands in Oregon; the two sets of laws are cooperative.
        - Under state and federal law Oregon DEQ and the EQC set water quality standards and also issue Total Maximum Daily Loads for water quality limited waterbodies.
        - Under state law (Oregon FPA), ODF and the Board of Forestry set forest practice rules to ensure forest practices achieve water quality standards and meet TMDL load allocations on non-federal forestlands.
    - FPA policy is to protect natural resources including water quality, fisheries, air quality, soil resources, and wildlife.
    - Protecting Cold Water criterion of Temperature standard is designed to protect fisheries and other aquatic resources by limiting human impacts to temperature regime. Stream systems are already heavily impacted by past human activities, and EQC policy is to prevent further impacts from human activities on fisheries and other beneficial uses.

BOF Chair Imeson:

- Complimented rules, pointed out the commitment to meet EQC's water quality standards, specifically mentioned Protecting Cold Water criterion.
- Area lacking information is small Type-N streams.
- Reframed question #4 to say FPA isn't just about fish but water resources including PCW.
- In favor of taking action even if information isn't perfect.

EQC Chair O'Keeffe:

- Importance of framing issues for policy makers and giving full range of scientific studies.
- Issues come from 2 sources: EPA (federal policy) and legislators.
    - DEQ staff brief EQC, have working groups, etc.
- At decision point:
    - Staff report with recommendation.
    - Careful review.
    - Look for areas of disagreement in working group.
    - Public comments.
    - Ecological effects, human effects, legal effects.
- Uncertainty always present.
    - How existing information is summarized is very important.
    - What are the effects of small changes?
- Question #4 is wrong framing.
    - Not EQC's role to be proscriptive but interested in outcomes.
    - What do we do if a standard is unattainable? [Largely, it is attainable.]

Fish and Wildlife Commissioner Akelson:

- Can we look at longer periods of time?
- Eastside forests need attention.
- Studies seem to validate forest practice rules.
    - Doing what they are supposed to do.

- Should be used as controls to evaluate future improvements and alternative management types—innovation and adaptive management rather than standing still.

Representative Brad Witt:

- Believes that no one in the legislature knows enough to guide forestry policies and it should be left to the BOF.
- Keep legislature out of it.
- Checking that BOF uses best available science:
  - Are results unique to OR?
  - Other states, countries researching? [They are.] Results?
  - Peer-reviewed?
- Critics of this information and interpretations? And why?
- Are suspended sediment and streamflow increases meaningful?
- Less water retention in the uplands—Is this a problem?
- He was on the BOF and wasn't convinced that protection was adequate on headwaters and uplands.
  - Feels better after being witness to workshop.
- Made a funny joke about the Higgs boson, so he likes science.

Mike Jones from Resiliency Alliance:

- **Reference:** Chapin, Koffins, and Folke "Principles of Ecosystem Stewardship: Resilience-based Natural Resource Management in a Changing World".
- Spatial and temporal variation, material pulses are important to maintain.
- Have to keep monitoring.
- Develop resilience-based models of management.
- Active adaptive management experimenting with pushing boundaries of resilience to see where they are. [I think we have covered that!].

Miscellaneous Notes:

- Jeff Light asked Jane O'Keeffe about eliminating or changing PCW criterion, repeating claim about heat not moving downstream.
  - Put J O'K on the spot about talking to Standards staff.
  - J O'K responded that she could ask staff about reviewing.
- Rep. Witt said that environmental groups' opinions are critically important.
  - Are there other perspectives that we are not hearing?
  - Talks about OR continuing to have the "best protection in the world".
  - Could use information about surrounding states.
- M. Jones said we need more values discussion especially connecting urban and rural values.
- H. Akelson said to involve ODFW staff in studies.
- Dean Maness closed by saying the standard in the forester's ethic is to leave the land better than you found it, not just "don't screw it up".
  - Did appear that the argument about changes being "within the range of natural variability" and equating that with "no effect" got some traction.
  - Suggested using Quality Control experimental design.
  - Consideration of best place to put effort.
  - Longer-term research needed.

        - Need long-term research sites for private forest practices in adaptive management context.
- Organizing committee for workshop was very heavy with industry representatives:
    - Liz Dent, Chris Jarmer, Jeff Light, Gary Springer, Arne Skaugset, Mike Cloughsey.

References:

Chapin, Koffins, and Folke "Principles of Ecosystem Stewardship: Resilience-based Natural Resource Management in a Changing World"

Comprehensive Economic and Environmental Assessment Tool.

Dubé *et al* 2010 (WA CMER 08-801)

Furniss, M. J., S. Flanagan, and B. McFadin. 2000. (Hydrologically-Connected Roads: An Indicator of the Influence of Roads on Chronic Sedimentation, Surface Water Hydrology, and Exposure to Toxic Chemicals. Stream Notes. URL: http://www.stream.fs.fed.us/news/streamnt/ jul00/jul00_2.htm)

Gravelle & Link 2007

Gregory *et al* 2008

Hicks *et al* 1991

Ice & Stednick, 2004 from *Forest History Today*

Ice & Shilling 2012

Jackson *et al* 2001

Janisch *et al* 2012

Karwan *et al* 2007

Kibler *et al* (in press)

Martin 2009 (Forest Road Runoff Disconnection Survey of Private Timberlands in Washington. Washington Forest Protection Association, Olympia WA.)

McBroom *et al* 2008

Mellina and Hinch 2009 (meta-analysis with no buffer)

NCASI TB 799

Reiter *et al* 2009 on turbidity patterns in a Western WA watershed, which interpreted turbidity decreases as being due to roads.